Patent Application of

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for

CLIPLESS BICYCLE PEDAL

BACKGROUND OF THE INVENTION

A number of clipless pedal designs have been made commercially available. The first clipless pedals were single side entry because they had latch and release mechanisms on only one side of the pedal. The next clipless pedals were double side entry because they had latch and release mechanisms on opposite sides of the pedal. The advantage of double side entry is that it is easier for the rider to clip into the pedal without looking. The disadvantage is that double side entry pedals are generally more complex and heavier than single side entry pedals.

A cleat is attached to the bottom of each cycling shoe and when the rider steps onto the clipless pedal and applies force, the latch mechanism opens to accept the cleat and then latches shut to lock the cleat to the pedal. The rider releases himself or herself from the pedal by twisting their shoe past a given angle. Pedal/cleat designs can allow float or not depending on the pedal and cleat design. Float is when the cleat is free to pivot through some angle such as 5 degrees each direction before making contact with the release mechanism. Some riders prefer to have float because of knee comfort and others prefer no float. Some pedals offer one cleat that allows float and a different cleat that allows no float.

Clipless pedals either have the latch mechanism in the pedal or in the cleat which is attached to the shoe. Designs with the latch mechanism in the cleat are generally lighter but perform poorly in muddy conditions because cleats are usually larger and have moving parts and are prone to getting clogged with mud and dirt from occasional walking on the ground. Also, because they are usually larger, they can interfere with walking. Designs with the latch mechanism in the pedal generally consist of a relatively large number of components making them complex to manufacture and maintain, and relatively bulky and heavy. Also, while designs with latch mechanisms in the pedal are less prone to clogging with mud than designs with the latch mechanism in the cleat, most are still susceptible to clogging under certain conditions which makes some pedals difficult to lock into and others difficult to clip out of.

In order to prevent release while pulling upwards while pedaling, either the spring (s) that holds the mechanism closed needs to be very strong or the geometry must be designed such that when the cleat is pulled straight up, there is not a component of force to cause the mechanism to release.

Spring loaded latch mechanisms on existing pedal designs have clasps that pivot about axes that are not coincident with the axis of pedal rotation. There is some distance between the pedal axis and the clasp axis or axes. Because of this, existing pedal designs have a framework to support the clasp axle and this causes the pedal to be relatively bulky in size.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a clipless pedal for bikes which is made with four sides which can engage the cleat.

Another object of the present invention is to provide a clipless bike pedal system which is sturdy enough to meet the rigorous demands of mountain biking yet is easy to use.

Another object of the present invention is to provide a cleat for use with clipless bike pedals which is easy to engage and disengage and is resistant to effects of dirt or debris which might otherwise damage or incapacitate a locking mechanism.

Another advantage of the present invention is to provide a cleat for use with clipless pedals which is small enough to be substantially retained within the recessed area in the soles of commercially-available mountain bike shoes so that it is generally protected from impact and does not interfere with walking.

Another object of the present invention is to provide a clipless bike pedal system which minimizes the distance from bottom of the cycling shoe to the centerline of the pedal to lower the rider's center of gravity and make pedaling more stable.

Another object of the present invention is to provide a clipless bike pedal system which minimizes the distance from the centerline of the pedal to the bottom of the pedal for improved ground clearance while pedaling.

Another object of the present invention is to provide a clipless bike pedal which has easy maintenance including easy disassembly and reassembly.

Another object of the present invention is to provide a clipless bike pedal system which is relatively light in weight.

Another object of the present invention is to provide, by virtue of its simplicity, a clipless bike pedal that is highly resistant to clogging with mud.

The foregoing and other objects are attained, according to the present invention, by a pedal including a spindle with a thread on one end for attachment to a bicycle crank arm, a substantially cylindrical housing that rotates about the spindle on bushings or bearings, two substantially U-shaped members that are made from bent wires that are affixed to opposite sides of the housing, two sleeves that slip over opposite ends of the housing allowing the sleeves to rotate concentrically about the axis of the spindle, two substantially U-shaped members that are made from bent wires that are affixed to opposite sides of the sleeves, a torsion spring that is concentrically positioned over the housing such that it holds the U-shaped members that are attached to the housing perpendicular to the U-shaped members that are affixed to the sleeves, and a cleat for mounting on the bottom of a bicycling shoe that can releasibly engage between any of the four adjacent pairs of substantially U-shaped members. The spring has a coil axis that is coincident with the spindle axis. A threaded plug retains the housing assembly on the spindle. An O-ring seals the housing against the Spindle on one end and another O-ring seals the housing against the plug on the other end. A spacer holds the spring in position. The housing, sleeves, bent wire members, spindle, and cleat are made of stainless steel, titanium, or some other material that has the strength and corrosion resistance required. The cleat has two shoulders that can engage under the bent U-shaped members.

When assembled, the housing spins freely on the spindle via either bushings or bearings. The spring holds the bent U-shaped member pairs generally perpendicular to each other but allows relative rotation in both directions between them when enough force is applied to overcome the spring. In this way the cleat can snap into any of four sides of the pedal. The cleat is released from the pairs of bent U-shaped members when the cleat is sufficiently twisted. The cleat can be designed to spread the bent U-shaped member pairs which causes at least one of the two cleat shoulders to release from the pedal. This design requires the rider to twist the shoe hard enough to overcome the spring pressure that holds the bent U-shaped member pairs perpendicular. Alternatively, the cleat can be designed so that upon sufficient rotation of the shoe, one or both cleat shoulders are no longer engaged with the bent U-shaped member pairs. This design does not require the rider to overcome spring pressure. A third variation of cleat allows a certain amount of freeplay (float) prior to the cleat beginning to spread the bent U-shaped member pairs.

By virtue of the simplicity and openness of the pedal's structure, it is unlikely that mud will clog the pedal. Also, because the cleat has no moving parts, mud is less likely to cause problems when locking into the pedal.

The spring loaded locking mechanisms herein described are applicable to any number of releasable attachment applications and are not limited to use on clipless bicycle pedals. The locking mechanism provides easy engagement, a durable attachment which allows a limited amount of relative motion and easy disengagement by cleat rotation.

A typical double side entry prior art clipless pedal, US patent number 5,203,229, has 40 components including the cleat. Conversely, the pedal herein has only 16 components including the cleat and only 11 independent components after a welding or soldering process.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and advantages of the present invention, as well as additional objects and advantages thereof will be more fully understood hereinafter, as a result of a detailed description of preferred embodiments thereof, when taken in conjunction with the following drawings in which:

FIG. 1 is a perspective view of the pedal;

FIG. 2 is an exploded perspective view of the pedal and cleat;

FIG. 3 is a side view of the pedal with the wide latches in an up and down orientation;

FIG. 4 is an end view of the pedal shown in Fig. 3;

FIG. 5 is a cross sectional view of the pedal assembly shown in Fig. 3;

FIG. 6 is a side view of the pedal rotated 90 degrees from the pedal shown in Fig. 3;

FIG. 7 is a cross sectional view of the pedal assembly shown in Fig. 6;

FIG. 8 is a top view of the cleat engaged with the pedal;

FIG. 9 is a cross sectional view of the pedal and cleat shown in Fig. 8;

FIG. 10 is an end view of the pedal and cleat shown in Fig. 8;

FIG. 11 is an end view of the pedal shown in Fig. 10 with the wide latch rotated to allow engagement of the cleat;

FIG. 12 is an end view of the pedal and cleat shown in Fig. 10 with the cleat engaged between a different pair of latches and the pedal rotated 90 degrees; and

FIG. 13 is an end view of the pedal shown in Fig. 12 with the wide latch rotated to allow engagement of the cleat.

The description herein refers to reference numerals in the accompanying drawings and these reference numerals refer to the parts therein having the following definitions:

REFERENCE NUMERALS IN DRAWINGS

10	clipless bicycle pedal	20	spindle
22	bearing surface	24	thread
26	flange	28	thread
32	hexagonal hole	40	spacer
50	spring	52	spring leg
54	spring leg	60	first sleeve
62	boss	64	boss
66	boss	80	second sleeve
84	boss	86	boss
90	housing	92	housing boss
110	narrow latch	120	wide latch
130	bushing	140	end plug
142	oring groove	144	hexagonal hole
146	thread	150	oring
160	oring	170	cleat
172	shoulders	174	mounting holes
176	surface		

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

The preferred embodiment of the present invention may be understood by referring to FIGs. 1-13. It will be seen that a pedal **10** comprises a spindle **20**, a cylindrical housing **90** that rotates about the spindle on two bushings **130**, two narrow latches **110** made from bent wire so they become substantially U-shaped members that are affixed to opposite sides of the housing **90**, a first sleeve **60** and second sleeve **80** that slip over the opposite ends of the housing **90** allowing the sleeves **60** and **80** to rotate concentrically about the axis of the spindle **20**, two wide latches **120** made from bent wire so they become substantially U-shaped members that are affixed to opposite sides of the housing **90**, a torsion spring **50** that is concentrically positioned over the housing **90** such that it holds the wide latches **120** perpendicular to the narrow latches **110**, and a cleat **170** for mounting on the bottom of a bicycling shoe that can engage on any of four sides of the pedal **10** between any of the four adjacent pairs of wide latch **120** and narrow latch **110** combinations. A threaded end plug **140** retains the housing **90** on the spindle **20**. An Oring **160** seals the housing against the spindle on one end and an Oring **150** seals the housing against the plug on the other end. A spacer **40** is pressed onto the housing **90** and holds the spring **50** in position. The housing **90**, sleeves **60** and **80**, latches **110** and **120**, spindle **20**, and cleat **170** are preferably made of stainless steel, titanium, or some other material that has the strength and corrosion resistance required. The cleat **170** has two shoulders **172** that can engage between the latch pairs **110** and **120**.

In FIG. 1, the pedal **10** has a spindle **20** which can rotate within the housing **90**. In the assembly, two narrow latches **110** are soldered or welded to the four bosses **92** of housing **90**. two wide latches **120** are soldered or welded to the bosses **64** and **66** of a first sleeve **60** and bosses **84** and **86** of a second sleeve **80** and can swivel up to about 70 degrees in both directions from being perpendicular to the narrow latches **110**. A torsion spring **50** is concentrically positioned over the housing **90**. The spring legs **52** and **54** hold the wide latches **120** perpendicular to the narrow latches **110** by forcing sleeve boss **62** to be aligned with a housing boss **92**. The spring **50** is forced to unwind whenever the wide

latches **120** are pushed away from perpendicular to narrow latches **110** regardless of the direction moved. An end plug **140** retains the housing **90** to spindle **20**.

In FIG. 2, the spindle **20** has a thread **24** that screws into a bicycle crank arm (not shown), a bearing surface **22**, a flange **26**, and a thread **28** that fits end plug **140**. A spacer **40** is pressed onto the housing **90** and encloses an o-ring **160** that in effect seals the spindle **20** to the housing **90**. The spacer **40** also holds the spring **50** closely to the first sleeve **60** and takes out slop between the housing **90** and the spindle flange **26**. The spring **50** has legs **52** and **54** that align sleeve boss **62** with a housing boss **92**. After the first sleeve **60** is slipped onto one end of housing **90** and the second sleeve **80** is pushed onto the other end of housing **90**, then the two wide latches **120** are welded or soldered to the bosses **64** and **66** of sleeve **60** and bosses **84** and **86** of sleeve **80**. The two narrow latches **110** are welded or soldered to the housing bosses **92**. Two bushings **130** fit inside the housing **90** and ride against bearing surface **22** of spindle **20**. An end plug **140** has an o-ring groove **142** that holds o-ring **150** and seals against the inside of housing **90**. The end plug **140** screws to thread **28** of spindle **20** and is tightened by a hexagonal key placed inside the hexagonal hole **144**. A cleat **170** has two shoulders **172** and two mounting holes **174**. The only maintenance required will be occasional replacement of the bushings **130** and the occasional replacement of cleat **170**. To replace the bushings **130**, plug **140** is removed using a hexagonal key. Then the spindle **20** can then be pulled out of the housing **90** which will leave the bushings **130** readily accessible for inspection or replacement. Both the narrow and wide latches, **110** and **120** respectively, are made from substantially U-shaped members.

In FIG. 3, the pedal **10** is shown with the wide latches **120** in an up and down orientation. One of the two narrow latches **110** can be seen.

In FIG. 4, the pedal **10** shows wide latches **120** that are held perpendicular to the narrow latches **110** by spring **50** (not shown) legs **52** and **54**. Neglecting the spring **50** (not shown in this Fig.), the pedal **10** is substantially symmetric about the two centerlines shown.

FIG. 5 shows that the narrow latches **110** are welded or soldered to the bosses **92** so they become rigid members of the housing structure. The thread **146** of end plug **140** is screwed to thread **28** of spindle **20**. The two bushings **130** allow the spindle **20** to rotate relative to the housing **90**. O-rings **150** and **160** keep outside contamination such as water and dirt away from the bushings **130**. Spacer **40** is pressed onto the housing **90** and prevents the housing **90** from sliding towards the hexagonal hole **32** of spindle **20**.

In FIG. 6, the pedal **10** is rotated such that the pedal has the narrow latches **110** in an up and down orientation. One of the two wide latches **120** can be seen.

FIG. 7 shows the wide latches **120** are welded or soldered to the bosses **64** and **66** of sleeve **60** and bosses **84** and **86** of sleeve **80**.

In FIG. 8, the cleat **170** is engaged with the pedal **10**. The two shoulders **172** of cleat **170** are caught underneath a narrow latch **110** and a wide latch **120**. Two mounting holes **174** are used to attach the cleat **170** to a cycling shoe (not shown). The cleat **170** is symmetric about the centerline shown. When the cyclist twists their foot, cleat **170** will twist which causes the wide latch **120** to move away from the narrow latch **110** which will release the cleat from the pedal upon sufficient twisting. The cleat is designed to allow a few degrees of float (twist without spring force) prior to causing the latches **110** and **120** to spread.

FIG. 9 shows that the surface **176** of shoulder **172** of cleat **170** is curved about the centerline of spindle **20** so that as the latches **110** and **120** rotate to accept shoulders **172**, the cleat **170** does not move relative to spindle **20**. Bushing **130** allows the housing **90** to rotate about the spindle **20**.

In FIG. 10, cleat **170** is shown locked between one of the adjacent pairs of wide and narrow latches **120** and **110**, respectively of the pedal. Spring legs **52** and **54** hold the narrow latch **110** perpendicular to the wide latch **120**.

In FIG. 11, the wide latch **120** is rotated to allow engagement of the cleat **170**. This rotation occurs from the cyclist pressing his or her foot downwards which causes the shoulder **172** of cleat **170** to push apart the wide latch **120** from the narrow latch **110** by overcoming the spring pressure that normally holds the wide latches **120** perpendicular to the narrow latches **110**. Spring end **54** pushes against boss **62** while spring end **52** pushes against boss **92**. When the cleat **170** has pushed the wide latch **120** sufficiently far from narrow latch **110**, wide latch **120** will snap over surface **176** of shoulder **170** such that it locks the cleat to the pedal as shown in Fig. 10.

In FIG. 12, the cleat **170** is engaged between a different pair of latches **110** and **120** than shown in Fig. 10 and the pedal is rotated 90 degrees. Because the cleat **170** is substantially symmetric, it can lock into the pedal with the wide latch **120** or the narrow latch **110** at the front and it will feel the same to the cyclist. There is sufficient clearance beneath the cleat **170** to not interfere with the spring ends **52** and **54**.

In FIG. 13, the wide latch **120** is rotated to allow engagement of the cleat **170**.

OTHER EMBODIMENTS

Now that the preferred embodiment is described, those skilled in the art will readily imagine other embodiments. For example, the latches **110** and **120** could be made of materials other than bent wire such as machined or forged metal and could have cross sections that are not round. Also, latches **110** and **120** are made from substantially U-shaped wire members which could have many variations of bends or curves and still be described as having a U-shape. Essentially, the latches can be made from any variation of hooked members as long as they provide a surface for the shoulders of the cleat to lock underneath. For example, the latches could have multiple curves or straight sections. It is also possible to describe the latches in the preferred embodiment as having a substantially rectangular shape instead of U-shape because the four U-shaped latches could be viewed as being two rectangular latches.

Also, the housing **90** and narrow latches **110** could be machined or formed from a single piece rather than three parts soldered together. The bushings **130** could be bearings such as needle bearing cartridges or ball bearings instead of bushings. There are many alternative configurations possible that would spring-load the latch pairs to be perpendicular to each other and yet allow motion in both directions. For example, there could be one spring on each end of the housing such that each spring is only twisted in one direction. Another alternative is a single spring that has one end keyed to the housing and the other keyed to one of the sleeves so that when the wide latches are moved in one direction, the spring unwinds and when moved in the other direction, the spring winds tighter. Other types of springs are also possible, such as using elastomers or compression or extension springs. While the preferred embodiment has four latches giving it four sides to lock into, another embodiment could be three sided, or five or more sided. For example, someone skilled in the art, based upon the present disclosure could readily design a six sided pedal using six substantially U-shaped members wherein a spring or springs hold each member about 60 degrees apart from adjacent members.

It will thus be evident that there are many additional embodiments which are not illustrated above but which are clearly within the scope and spirit of the present invention.

The above description and drawings are therefore intended to be exemplary only and the scope of the invention is to be limited solely by the appended claims. We claim:

ADDITIONAL REQUEST FOR CONSTRUCTIVE ASSISTANCE

If for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner, pursuant to M.P.E.P. 706.03 (d) and 707.07(j) in order that the undersigned can place this application in allowable condition as soon as possible without the need for further proceedings.